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Memorandum

Gradient

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Date: August 4, 2010

From: Kurt Herman, M. Eng., P.G.

Subject: Follow-up to the June 21, 2010 Meeting with US EPA Region V Regarding the Ashland Allocation Report

I have prepared this technical memorandum in response to several points raised in the June 21, 2010 meeting with US EPA Region V regarding the Ashland Allocation Report. The electronic version of this memorandum includes hyperlinks to supporting documents (*e.g.*, Sanborn maps, deposition excerpts). The hard copy of this memorandum includes supporting documents, organized and referenced by tab number.

I. Sensitivity Analyses

A. The sensitivity analyses consist of evaluating two separate scenarios (Scenarios 1 and 2, below). The results from each scenario are compared to the allocation results[1] presented in the Allocation Report, providing the net difference (if any) on the shares allocated to the PRPs.

B. Scenario 1: Zero Owner Share for City: Kreher Park (KP) ownership intensity ([maximum size, in acres] x [duration, in years]) is an allocation factor used in the KP sub-allocation. Even by hypothetically reducing the City's Owner share to 0%, the City still retains a large overall cost share (16%) based on its involvement in KP activities that caused releases (*e.g.*, constructing the Wastewater Treatment Plant (WWTP) and draining the Coal Tar Dump (CTD)).

Scenario 1. Zero owner share for City, all else equal

	OVERALL			
	Schroeder	NSPW	City	All Others
Allocation Results[1]	29%	37%	24%	11%
Effect of Reducing City Owner Share to Zero	30%	37%	16%	17%
Net Difference from Allocation Results	+1%	0%	-8%	+6%

Note: 1) Allocation results presented in the June 2, 2010 Allocation Report.
2) Shares do not sum to 100% due to rounding; Net Difference does not sum to 0% due to rounding.

[1] See Allocation Report Table 7.2 [Tab 1].

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C. Scenario 2: Inverting PRP Type Weighting: Weighting based on PRP type[2] is used to derive divisible shares in the Allocation Report for KP, where operator shares are weighted double (2x) that of owners and generators (1x). Independent of the sensitivity analysis performed in Scenario 1 (above), I have evaluated the net difference of inverting the operator and generator share weighting (*i.e.*, decreasing the operator share weighting to 1x and increasing the generator share weighting to 2x), with all other factors remaining the same.

D. Inverting the PRP type share weighting does not significantly impact the overall allocation results. The three main PRPs (Schroeder, NSPW, and the City) retain a large combined share of costs, and each of these PRPs retains a significant individual share.

Scenario 2. Decrease operator share weighting to 1x and increase generator share weighting to 2x, all else equal

	OVERALL			
	Schroeder	NSPW	City	All Others
Allocation Results[1]	29%	37%	24%	11%
Effect of Inverting Operator and Generator Share Weighting	34%	41%	15%	10%
Net Difference from Allocation Results	+5%	+4%	-9%	-1%

Note: 1) Allocation results presented in the June 2, 2010 Allocation Report.
2) Shares do not sum to 100% due to rounding; Net Difference does not sum to 0% due to rounding.

Sensitivity analyses demonstrate the overall certainty of the allocation model. These two scenarios demonstrate that the divisible shares presented in the Allocation Report are reasonable and appropriate, and that the overall results are fundamentally the same.

[2] Owners, Operators, and/or Generators.

II. The "Coal Tar Dump"

A. As discussed in the Allocation Report and accounted for by the allocation framework,[3] the Coal Tar Dump (CTD) is a pivotal feature at the Ashland Site. The following timeline describes key points about the CTD and the PRPs' relationship to it.

i. Prior to and including the 1930s: Schroeder treated wood in open tanks in the approximate location of the CTD.

1. At least five eyewitnesses described this wood-treating operation (Figure 1 [Tab 3]).
    a. T. Roy (1999 Affidavit [Tab 4]).
    b. R. Parent (2001 Deposition [Tab 5]).
    c. F. Kucinski (1998 Affidavit [Tab 6a]; 2001 Deposition [Tab 6b]).
    d. G. Parent (1995 Affidavit [Tab 7a]; 1998 Interview-Feb. [Tab 7b]; 1998 Interview-Sep. [Tab 7c]; 1998 Affidavit [Tab 7d]; 1998 Interview-Oct. [Tab 7e]; 2001 Deposition [Tab 7f]).
    e. J. Selner (1999 Affidavit [Tab 8a]; 2000 Affidavit [Tab 8b]; 2001 Deposition [Tab 8c]).

Multiple, independent eyewitness accounts corroborate that the same type of wood-treating operation occurred in the same general location, demonstrating the strength of the overall conclusion. (see II.A.i.1 and II.A.i.2)

2. Other Ashland residents anecdotally recalled that Schroeder treated wood (*e.g.*, K. Veno 1995 Affidavit [Tab 9a]; 2003 Deposition [Tab 9b]; T. Nelson 1995 Affidavit [Tab 10]).

The type of wood-treating process described by eyewitnesses was common at the time, further confirming the likelihood that wood treating occurred. (see II.A.i.3)

3. Open-tank wood treating was a common technique during this time period (see *e.g.*, Achatz, 1920, pp. 16-17 [Tab 11a]; Downey, 1937 [Tab 11b]; Crawford, 1908 [Tab 11c]). The second page of the Downey (1937) article published in the *Journal of Forestry* has a photograph of open wood-treating tanks of the general type described by eyewitnesses.
4. Forensic sampling by Newfields (2006) confirms wood treating in the CTD area (Figure 2 [Tab 12]; Newfields Report Excerpt [Tab 13]):
    a. Diagnostic wood-treating chemicals, including pentachlorophenol (PCP; Newfields figure [Tab 14]), other phenols (Newfields figure [Tab 15]), creosote, and diesel, are present. PCP, a "valuable wood-preserving chemical," was produced commercially by 1936 (Carswell and Nason, 1938 [Tab 16]), and PCP concentrations are correlated with high PAH concentrations. This is consistent with amending a wood-treating feedstock, such as creosote, with PCP to improve its preservative characteristic.
    b. The presence of diesel is consistent with a US EPA publication [Tab 17] that describes wood-preserving fluid compositions.

Multiple, independent lines of forensic chemistry evidence all point to the same conclusion – Schroeder treated wood in the CTD area. (see II.A.i.4)

[3] See Allocation Report excerpts [Tab 2]: Section 2.3 (pp. 5-6); excerpt from Section 4.1.1 (p. 12); excerpt from Section 5.1 (p. 18); excerpt from Section 5.2 (p. 20); excerpt from Section 5.4 (pp. 22-25); Table 5.3; excerpt from Section 6.2.2 (pp. 32-34), including Tables 6.2 to 6.4; Appendix E [depictions of ownership in and around the CTD]; and Appendix F [excerpts from Greeley & Hansen plans].

c. Wood impregnated with NAPL (*i.e.*, treated wood) was frequently found in the CTD and in piping that appears to have drained the CTD to the west (Newfields figure [Tab 18]).

5. Schroeder's articles of incorporation state that it intended "to own and operate wood preservation plants" (Schroeder's Articles of Incorporation, Item No. 2 [Tab 19]).

6. Historical maps and aerial photos:

   a. Wood-treating tanks were not depicted on 1909 or 1923 Sanborn Fire Insurance maps (Sanborns [Tab 20]).

   b. According to a Sanborn company representative, it is not uncommon for Sanborn Fire Insurance Maps to omit features (Sanborn letter [Tab 21]).

   c. A dark rectangular structure was present on a 1939 aerial photo (1939 Aerial Photo [Tab 22]). This is approximately the same location as the CTD/tank location from eyewitness accounts and may be one of the wood-treating tanks.

The aerial photo supports the presence of a wood-treating structure in 1939, whereas the older maps neither confirm nor refute the presence of wood-treating structures at earlier dates. (see II.A.i.6)

7. Environmental professionals working independently for DNR (SEH [Tab 23a and Tab 23b], MSA [Tab 24], and Northern Environmental [Tab 25]) identified Schroeder's wood treating as a potential source of KP contamination.

Each of these independent lines of historical and environmental evidence build on each other to reach the same conclusion – Schroeder treated wood in and around what later became the CTD. (see II.A.i.1 to 7)

ii. 1939-1942: Schroeder demolition was apparently performed by Schroeder and sanctioned by the County.

1. 1939 – The County formed the Schroeder Mill Committee "to act as managers and have control over said property" (County Board Proceedings [Tab 26]).

2. 1939 – The County directed the Schroeder Mill Committee to salvage Schroeder property "at once" (County Board Proceedings [Tab 27]).

3. 1939 – Buildings and equipment were transferred back to Schroeder (News Article [Tab 28]; 1939 County Board Proceedings [Tab 29]).

4. 1940 – Demolition was underway (1940 News Article [Tab 30]). There are no specific details on the wood-treating tank's demolition, including disposition of the tank contents.

5. 1946 – A Sanborn map confirms demolition took place, noting "All Docks, Bldgs, Tramways an [*sic*] Lumber Piles Removed" (1946 Sanborn Fire Insurance Map [Tab 31]).

Even though details are incomplete, it appears that Schroeder and the County had a role in demolition activities, and that the CTD first appeared shortly after Schroeder's demolition took place. (see II.A.ii)

The CTD first appeared shortly after Schroeder's demolition took place when the City owned and controlled KP. (see II.A.iii)

iii. Late 1940s/Early 1950s: The CTD was present (Table 5.3 from Allocation Report with backup [Tab 32a-n]) on property the City owned and controlled (Figure 3 [Tab 33]).

iv. 1951: An engineering drawing depicted a 2-inch tar pipe from the MGP site toward the CTD. As explained below, this 2-inch tar pipe was an unlikely conduit for MGP demolition tar, but instead may have been the pipe used to transfer tar to rail cars in the Seep Area, and/or used to convey tar to Schroeder for wood treating use.

The G&H plans are inconclusive as to direct discharge from the MGP to the CTD because they do not show the 2-inch tar pipe extending beyond the Upper Bluff to the CTD. (see II.A.iv.1 and 2)

1. A 1951 Greeley and Hansen engineering plan depicted a 2-inch tar pipe on the Upper Bluff beneath St. Claire Street (1951 G&H Plan A [Tab 34]).
    a. The pipe appears to be labeled "2" Tar to Abandoned Tar Dump."
    b. The pipe was drawn at a shallow depth, about 2 feet below the street surface.
    c. The pipe did not extend beyond the Upper Bluff.
2. A second 1951 G&H plan detailing the CTD area did not show the 2-inch tar pipe extending to the CTD (the CTD was labeled "Waste Tar Dump" on this figure) (1951 G&H Plan B [Tab 35]).
3. Several eyewitnesses recalled that MGP workers used an approximately 2-inch pipe to transfer tar to rail cars in the Seep Area of KP (G. Parent 1998 Interview-Sep. [Tab 36a]; 1998 Interview-Oct. [Tab 36b]; 2001 Deposition [Tab 36c]; Kovach 2003 Deposition [Tab 37]; R. Parent 2001 Deposition [Tab 38]). This is generally consistent with the orientation of the 2-inch tar pipe on the 1951 G&H plan (1951 G&H Plan A [Tab 39]).

The CTD and Upper Bluff have distinct source signatures. If the MGP was the main source to the CTD, its source signature should match the Upper Bluff (like the Seep Area does). (see II.A.iv.4)

4. The CTD and Upper Bluff have distinct source signatures (Figure 4 [Tab 40]) based on the 6 PAH proportions.[4]
    a. If tar was discharged to the CTD during MGP plant decommissioning, the CTD signature should match the Upper Bluff signature (the confidence intervals would overlap). This is because the same tar that accumulated in MGP equipment (gas holders, tar wells) then leaked into the Upper Bluff subsurface would have been discharged to the 2-inch pipe when the MGP equipment was decommissioned.
    b. In contrast, the source signature in the Seep Area of KP is similar to the Upper Bluff based on the 6 PAH proportions (Figure 5 [Tab 42]). This is consistent with historical accounts of MGP tar released in the Seep Area during rail transfer operations.

[4] See Allocation Report Section 4.1 [Tab 41] for more details on these PAH proportions.

The fact that tar was a saleable commodity during the MGP decommissioning timeframe makes it unlikely that the MGP would simply discard it as a waste. (see II.A.iv.5)

5. Tar was a valuable commodity, and the MGP sold large amounts of tar in the years leading up to its c. 1947 decommissioning:
    a. ~70,000 gallons of tar was sold between 1939 and 1946 (1939; 1940; 1941; 1944; 1946 PSC Report excerpts regarding tar sales [Tab 43a-e]).
    b. There are also anecdotal accounts of tar sales to fisherman to waterproof their nets (Zak Deposition [Tab 44a]; 1998 Affidavit [Tab 44b]) during the same time period.
6. Even if tar was found in the CTD area, it is not diagnostic of tar disposal, because tar may have been used by Schroeder as a wood-treating feedstock. Although unconfirmed, the 2-inch tar pipe depicted on the G&H plan may have been used to transmit byproduct tar from the MGP for Schroeder to use as a wood treating feedstock, after amendment.
7. NSPW extensively excavated the Upper Bluff (1998; 2002) to locate the shallow 2-inch tar pipe depicted on the Greeley and Hansen figure, but no such tar pipe was found (Figure 6 [Tab 45]).
    a. During the 1998 investigation, NSPW did find a 2-inch steel pipe, but it did not contain tar.
        i. Crane Engineering forensically evaluated the pipe (both its contents and construction material). Crane concluded that the pipe did not contain NAPL and the pipe was a c. 1920s to 1940s vintage "common black pipe grade often used for water, compressed air, natural gas, and steam" (Crane 1988 Forensic Piping Report [Tab 46]).
    b. Later, during the 2002 investigation, NSPW found a different 2-inch tar pipe on the MGP property. It did not extend off the MGP site, and it was oriented in a different direction than the 2-inch pipe depicted on the 1951 G&H plan (labeled as Pipe #1 on a 2002 piping investigation figure [Tab 47]).

If the shallow 2-inch tar pipe was present, it should have been encountered during the 1998 and 2002 investigations.

The weight of this historical and environmental evidence indicates the tar pipe was an unlikely conduit for MGP demolition tar, but instead may have been the pipe used to transfer tar to rail cars in the Seep Area, and/or used to convey tar to Schroeder for wood treating use. However, NSPW's Generator Share for KP as assigned in the Allocation Report already accounts for its contribution to KP regardless of the exact mechanism. (see II.A.iv.1 to 7)

v. c. 1952: The CTD was drained to the Bay.

1. A 1952 engineering plan prepared by the City's contractor, Greeley and Hansen (G&H), depicted a large (12-inch) pipe and open ditch draining the CTD to the Bay (1952 G&H Figure [Tab 48]). This plan was part of a series of figures prepared by G&H for construction of the WWTP and for sewer system work.
2. There is a tPAH hot spot in Bay sediments at the open ditch discharge location (Figure 7 [Tab 49]). The highest tPAH concentrations are in sediments at intermediate depth (0.5-4 ft bss). This depth is consistent with a release that occurred decades ago that has since been buried by surficial sediments.
3. There was a dark area present in the CTD area in a 1951 aerial photo (1951 aerial photo [Tab 50]). This dark area was not present in the 1966 aerial photo (1966 aerial photo [Tab 51]). This is consistent with the CTD being drained of NAPL and then filled with solid material between 1951 and 1966.
4. The CTD was no longer depicted in a 1971 drawing prepared by Greeley and Hansen for the WWTP expansion (1971 G&H figure [Tab 52]).
5. A smaller amount (volume) of NAPL is present in the CTD today than in the 1950s (Allocation Report Table B.2 [Tab 53]). The missing volume may have gone through the 12-inch pipe and open ditch to the Bay.
6. The results of the sediment mixing model (Allocation Report Figure 6.1 [Tab 54]) – approximately 90% contribution from KP *versus* 10% from the Upper Bluff – is consistent with a large amount of NAPL released from draining the CTD.

These multiple lines of evidence are all consistent with the City draining the contents of the CTD to the Bay to facilitate its early 1950s WWTP construction project.
(see II.A.v)

B. The allocation approach provides a reasonable basis to account for the PRPs' relationship with the CTD (described above) using a weight-of-evidence approach that incorporates this relevant historical information and environmental data. For example:

i. NSPW's Generator share for all of KP, including the CTD, captures its relationship to the CTD. Even if byproduct tar from the MGP could have been piped there in 1952, other PRPs owned the CTD at this time and controlled its operation.

ii. NSPW also has an Operator share for its tar transfer activities in the Seep Area that took place *via* the 2-inch tar pipe. (This is distinct from the CTD).

iii. The City's Owner share for KP includes its ownership of the CTD.

iv. Schroeder's Operator share accounts for the likelihood that its demolition actions created the CTD.

v. The County's Owner share accounts for its ownership of KP during the time that the CTD was created by Schroeder's demolition actions.

vi. Schroeder's Generator share for all of KP, including the CTD, accounts for feedstock wood-treating NAPL releases that may have occurred during its operations.

vii. The City has an Operator share for draining the CTD. This share includes the actions of its agents (*i.e.*, contractors).

III. The Potential Contribution of Early MGP Releases to KP

A. Between 1885 (when the MGP started operating) and c. 1901 (when most of KP was filled), the MGP could have potentially discharged wastewater with entrained tar to portions of KP that were at the time submerged and later reclaimed by filling.

i. Such wastewater discharges would account for only a small fraction of the NAPL volume observed in KP today.

Realistic release estimates do not support the scenario that MGP discharges account for the majority of contamination found in KP today. (see III.A.i)

1. 1890 – The eastern portion of KP was filled in by 1890 (Sanborn Map [Tab 55]). At this time, the cumulative MGP tar production was less than approximately 25,000 gallons (Allocation Report Table D.2 [Tab 56]). Of this, only a smaller fraction (~500 gallons[5]) would have been released in wastewater based on conservative estimates. In comparison, there is on the order of approximately 100,000 gallons of NAPL (or more) in KP today (Allocation Report Table C.2 [Tab 58]).
2. 1901 – The rest of KP was mostly filled in by 1901 (Sanborn Map [Tab 59]). At this time, the cumulative MGP tar production was less than approximately 70,000 gallons (Allocation Report Table D.2 [Tab 56]). Of this, only a smaller fraction (~1,400 gallons[6]) would have been released in wastewater, based on conservative estimates. In comparison, there is on the order of approximately 100,000 gallons of NAPL (or more) in KP today (Allocation Report Table C.2 [Tab 58]).

The distinct Upper Bluff and KP source signatures are consistent with a relatively small volume of potential MGP tar released to KP. (see III.A.ii)

ii. The Upper Bluff and KP have distinct chemical source signatures (Allocation Report Figure 4.1 [Tab 60]) based on the 6 PAH proportions. This is consistent with the relatively small NAPL volume contributed by the MGP to KP.

iii. Most of KP at the time was actively used by the railroads and various lumber mills (including Schroeder and its predecessors).

Uncontrolled releases of MGP tar to KP would have likely interfered with rail and lumber operations and fouled valuable lumber. Therefore, such releases would have been unlikely. (see III.A.iii)

1. An 1890 lithograph [Tab 61] depicted lumber stacked at the mouth of the former ravine where it met KP.
2. An 1890 Sanborn map [Tab 62] depicted rail lines and Sutherland mill operations at the mouth of the former ravine where it meets KP.
3. An 1895 Sanborn map [Tab 63] depicted rail lines and a planing mill of Sutherland Lumber at the mouth of the former ravine where it meets KP.
4. A 1901 Sanborn Map [Tab 64] depicted rail lines and a closed planing mill at the mouth of the former ravine where it meets KP.

[5] Based on 1,000 mg/L tar in MGP wastewater and 1-10 gallons of wastewater per 1,000 ft^3 of gas produced (Allocation Report Tables 5.1 and 5.2 [Tab 57]).
[6] Based on 1,000 mg/L tar in MGP wastewater and 1-10 gallons of wastewater per 1,000 ft^3 of gas produced (Allocation Report Tables 5.1 and 5.2 [Tab 57]).

B. After 1901, KP was essentially filled to its current shoreline configuration (Figure 8 [Tab 65]) and potential discharges from the MGP would most likely have been to current Bay Sediments *via* the "clay tile" located in the base of the ravine.

i. Some type of conduit, possibly the clay tile pipe, was shown on an 1886 Sanborn map (1886 Sanborn [Tab 66]) in the base of the ravine. This conduit extended past the MGP site to the south as well as north toward KP.

ii. NSPW excavated a large portion of the former ravine in the Upper Bluff and unearthed a clay tile pipe at the former ravine's base (URS 2002 Clay Tile Pipe Report [Tab 67]). This pipe would have been the most likely effluent wastewater conduit.

iii. In 1902, the City of Ashland issued Ordinance No. 196 [Tab 68], which established a Board of Health and includes a series of 84 sections covering a wide range of topics, mostly focused on contagious disease and sanitary waste disposal (*e.g.*, Section 32, "Compensation of Night Scavengers"; and Section 53, "Accumulation of Filth Prohibited").

The City's 1902 Ordinance makes brief mention of MGP wastes (1 of 84 Sections) to authorize the method for their disposal – via underground sewer. (III.B.iii)

a. One of the 84 sections of this Ordinance (Section 57, [Tab 69]) addressed MGP wastes. It required that MGP wastewater discharges ("any gas, tar or any refuse matter of or from any gas house, works") to land or water ("any public water, river, canal, slip, bay or inlet or into any street, vacant lot or public place") be discharged through underground sewers ("[prohibited] except through underground sewer").

b. It is noteworthy that the Ordinance: 1) did not state whether such discharges had been or were occurring, and 2) did not ban such discharges. Instead, through Section 57 of this Ordinance, the City prescribed and authorized the method for MGPs to discharge their wastes as stated in the Ordinance section title – "Waste Products from Gas Plants to be Conducted Under Ground."

C. As described in the Allocation Report [Tab 70], the allocation approach provides a reasonable basis to account for potential MGP discharges from the Upper Bluff to KP. For example:

i. NSPW has a Generator share for KP that captures the potential contribution of early MGP wastewater releases to then-submerged portions of KP.

ii. NSPW's Sediment share is based on a mixing model that provides an objective, quantifiable basis for apportioning sediment impacts attributable to the Upper Bluff (that would include MGP discharges to current Bay sediment) *versus* KP. The mixing model results are in turn corroborated by engineering estimates of the amount of tar entrained in MGP wastewater effluent that may have been released to Bay sediments.

The historical information and environmental data, including both contamination signatures and estimated release amounts, do not support the scenario that MGP discharges account for the majority of contamination found in KP today. Further, NSPW's Generator Share for KP as assigned in the Allocation Report already accounts for its contribution to KP regardless of the exact mechanism. (see III.A to C)